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tions here and there of experiments, some of later date than Krall's book and others made in the presence of Mackenzie himself, including a few with the blind stallion, Berto (p. 39).

Mackenzie's standpoint is indicated pretty well by the following conjecture which he quotes with approval: "All that lives around us probably lives as we live, and the phenomena of our minds, even those believed to be specific and characteristic, are only a manifestation, different in degree, perhaps, but not different in principle from that of other like phenomena which are revealed to us little by little from remote provinces of universal nature" (p. 7). A somewhat uncritical attitude is, perhaps, betrayed by an occasional loose statement, by the acceptance of at least one very doubtful experiment of Krall's as valid, and especially by the following argument brought forward near the end of the paper (p. 42). Urging that the mathematical performances of the horses ought not to be held improbable because such feats would be difficult or impossible for most human beings, he continues: "But it is not to be forgotten that numberless organisms of the earth and water solve daily mathematical problems just as abstract; I mention only the classical cells of the bee. The supposed circumstance that these organisms neither know nor comprehend what they do, does not seem to me to be the thing precisely which would help our understanding of the enigma." But what sort of a parallel is there here? Is it not contended that the Elberfeld horses are conscious in their arithmetical work? Have they not been taught like human beings and are they not supposed to have grasped the number system? Or if this is not so, and they give their results, as the bee shapes her cell, without knowledge or comprehension of what they are about, what ground have we for crediting them with mathematical intelligence? May we not with equal justification credit them with intelligence in matters of chemistry and physiology because they digest their food?

(6.) *Der Streit um die rechnenden Pferde*, Vortrag, gehalten am 27 Februar, 1913, in der Psychologischen Gesellschaft in München von Dr. MAX ETTLINGER. Mit einem Anhang: Die gemeinsame Protesterklärung auf dem internationalen Zoologenkongress. Verlag Natur und Kultur, München. S. 54.

(6.) If the views of Krall find in Claparède a judge inclined to mercy and in Mackenzie an aggressive champion, they meet in Ettlinger a hostile and experienced critic. Ettlinger is a literary man and magazine editor of Munich, a student and writer of some years' standing in animal psychology, and one of the conservatives in the original Hans controversy.

His critique, to his regret, lacks one important feature—a firsthand study of the horses—but like a number of others of openly critical attitude, he has not been able to secure the chance for such a study under satisfactory conditions. His account of the horses and his estimates of the reliability of the results are therefore drawn of necessity from the printed sources and the personal reports of those who have been in this respect more fortunate than he.

After a brief resumé of the work of Pfungst, he adduces confirmatory evidence from other sources, especially from the practice of professional showmen, and then considers the performances of Krall's horses, giving chief though not exclusive attention to their mathematical feats. Ettlinger's contention is, of course, that Muhamed and Zarif are guided by visual or other signals given consciously or

unconsciously by persons within sensory range of the horses, and that the precautions which Krall and others have employed to exclude such guidance, have been insufficient. He lays especial stress on the wholly inadequate use of experiments "without knowledge."

Perhaps the portion of Ettlinger's discussion which will seem most interesting to the average reader is that in which he shows how easy it is for one with very moderate mathematical skill, aided by a very little special knowledge, to solve mentally examples in the extraction of roots which at first sight seem of so great difficulty that they have been employed at Elberfeld as experiments "without knowledge" on the ground that the answers were unknown to the spectators and could not be reached by any one present as promptly as they were gotten by the horses. Such an example as $\sqrt[4]{4084101}$ seems to the uninitiated a fairly embarrassing one for head reckoning, but when it is known that the last digit of any exact 5th power is always the same as the last digit of the root (and therefore in this case 1) and that the tens in the root are to be found from the figures remaining at the left, when the five at the right have been pointed off, here 40, it is easy to see that the root required can only be 21. The case is a little more complicated for cube roots, though here again the final digit of the power always bears an easily determinable relation to the final digit of the root. The errors made by the horses with examples in cube and fifth roots are also such as to support the hypothesis that the roots in both cases were obtained by estimate under guidance of knowledge of these special relations and not by actual calculation. Square roots and fourth roots offer much greater difficulty and appear not to have been so much used as the odd roots and when used to have been tried in a good many cases with relatively easy examples.

Of considerable interest also is the citation from the Düsseldorf veterinarian, Dr. Karl Wigge, who reports that at least in one instance he saw an opening and closing of the eyes of the groom coincident with the beginning and ending of a set of taps given by Muhamed, and that when on another occasion he could place himself in such a position that he could see the groom from head to foot the horses did not succeed at all. Wigge and others have likewise noted, as was observed also in the case of Hans, that the horses seem to pay little or no attention to the blackboard from which they are supposed to be reading or on which their problems have been written, from which the inference is easy that they are not reading or calculating at all.

And so the matter stands, with much assertion upon one side and much denial on the other, waiting for the crucial experiment which, however, is not likely to be made unless Herr Krall is willing to offer more facilities than he has yet been ready to offer to those whom he knows to be hostile to his views.

E. C. S.

Die Realisierung. Ein Beitrag zur Grundlegung der Realwissenschaften. Band I. By OSWALD KÜLPE. S. Hirzel, Leipzig, 1912, pp. vii, + 257.

The problem of *Realisierung*, as set forth in this book, is the problem of apprehending in and through experience that which truly exists or has existed (p. 3). Professor Külpe states further that his purpose is to provide a justification for a realistic theory of objectivity, and he announces that his plan contemplates the publication of four volumes, of which the present one is the first. In